

# TEMPERATURE CONTROL BOARD - Installation and Servicing Instructions

## OPERATION

The TCB is a microprocessor-controlled device that will supply the proper step signal to most Sporlan electric valves to position, initialize or close the valve. The TCB can be used as an interface with an external controller; or, with the addition of a set point potentiometer and sensor, can be used as a standalone temperature control.

In the interface mode, the TCB will modulate a valve in response to a signal received from an external source. In addition to the 0 to 10 volt DC, or 4 to 20 milliamp signal commonly used on PID controllers, the TCB can be configured to modulate a valve in response to a TTL (5 volt) signal, or a 120 volt AC pulse of three to thirty seconds duration.

When used as a standalone temperature controller, the board will modulate a valve in response to a set point potentiometer and temperature sensor. The temperature sensor is a 2K, type B, NTC thermistor. This mode is used for the control of step motor evaporator control valves, discharge bypass valves or any other application suitable for single point temperature control. Since superheat control requires at least two sensors, **superheat control for electric expansion valves cannot be accomplished with the TCB in temperature control mode.**

The TCB is capable of powering and controlling two valves, connect in parallel. The TCB has an operational range of -40°F to 210°F.

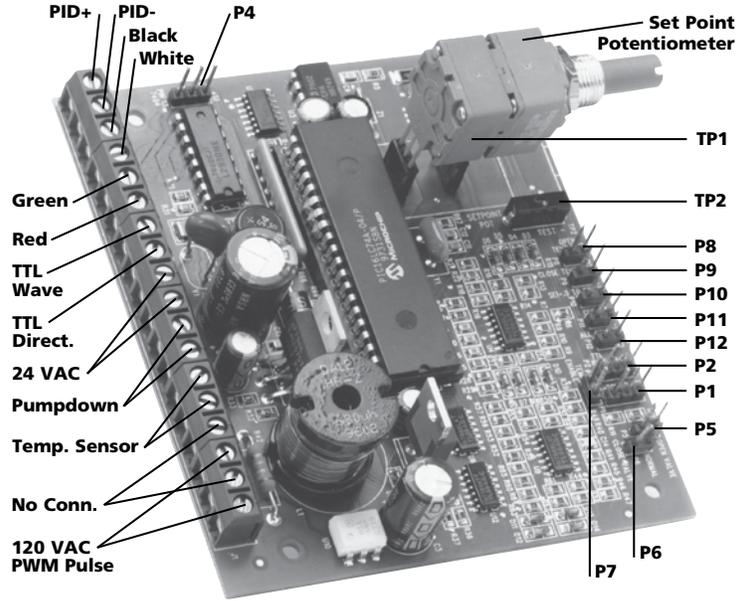


Figure 1

Valve	Steps	P10	P11	P12
SEI .5 - 11, SER	1596	XXX	—	—
SEI-30	3193	—	—	XXX
SEH, SEI-50	6386	—	—	XXX
CDS-8	3193	—	XXX	—
CDS-9 & 16	6386	—	—	XXX
SDR-3, 3X	3193	—	XXX	—
SDR-4	6386	—	—	XXX
OTHERS	6386	—	—	XXX

NOTE: Only one jumper is used.

Input	Source	P1	P2	P7
4-20 ma	External	L, C	—	—
0-10 VDC	External	C, R	—	—
TTL LOGIC	External	—	L, C	—
120 VAC PWM	External	—	C, R	—
TEMP. SENSOR	External	—	—	Top & Bottom

NOTE: L = left, R = right, C = center  
When board is viewed as shown in Figure 1.

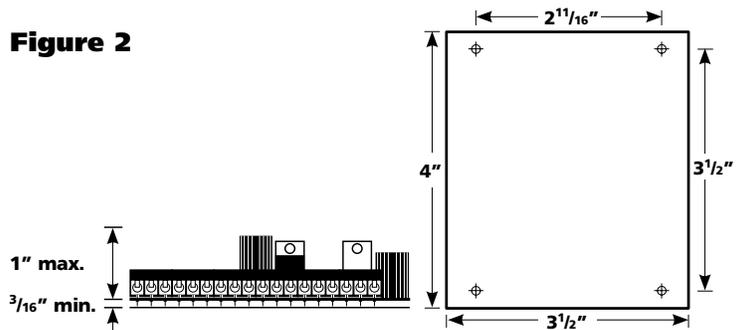
Item Number	Item Name	Use
952741	Set point potentiometer	Used to add temperature control to a TCB.
952669	Air sensor	Used with TCB in standalone mode for valve control via air temperature.
952662	Surface sensor	Used with TCB in standalone mode for valve control via refrigerant line temperature.
953276	SMA-12 Diagnostic Instrument	Used to test step motor operation.

## LOCATION AND INSTALLATION

For proper operation, the signal type and valve model must be selected from Tables 1 and 2, and the TCB configured accordingly.

The TCB must be installed in a dry, protected environment. The board will operate properly in ambient conditions of -40°F to 140°F, with 90% relative humidity, non-condensing. The board should never be mounted in a corrosive atmosphere or in a location where frost buildup is likely. The TCB is provided with four 1/8" mounting holes as shown in Figure 2. Non-metallic standoffs are suggested but not required. Minimum clearance from the bottom of the TCB to a conductive substrate or mounting panel is 3/16".

Figure 2



## WIRING and POWER SUPPLY REQUIREMENTS

Screw terminals suitable for up to 14 gauge wire are provided for all inputs and outputs. An **isolated secondary 24 VAC 40 VA transformer** must be used to power the board and valve. The transformer must not be used to supply power to any other device. External control signal wiring to the TCB should be kept as short as possible to prevent electrical noise and signal attenuation. The signal is polarized and care must be taken when connecting the wires to the (+) and (-) screw terminals. Terminals are arranged from top to bottom when the board is positioned with the component side up, and the terminal strip on the left as shown in Figure 1. Input signal requirements are shown in Table 3.

## WIRING CONNECTIONS

- PID+** - connect positive side of 4-20 ma or 0-10 VDC signal
- INPUT** - connect negative side of 4-20 ma or 0-10 VDC signal
- BLACK** - connect black valve lead
- WHITE** - connect white valve lead
- GREEN** - connect green valve lead
- RED** - connect red valve lead
- SQUARE WAVE DIRECTION** - connect TTL logic (5 VDC) step signal
- 24 VAC** - 2 connections for 24 VAC @ 40 VA isolated power input
- PUMPDOWN** - 2 connections for pumpdown contacts. When “shorted” the valve will close and remain closed. When “open” the valve will control normally. If the pin jumpers are installed on both pins of P5 and P6, “shorting” the pumpdown terminals will cause the valve to open fully. “Opening” the pumpdown terminals will cause the valve to resume normal operation.
- TEMP. SENSOR** - 2 connections for supplied 2 k type B thermistor. Not polarized.
- BLANK** - no connection - for high voltage input isolation.
- AC PULSE** - for one leg of 120 VAC, 3-30 second Pulse Width Modulated signal.
- BLANK** - no connection - for high voltage input isolation.
- AC PULSE** - for the other leg of 120 VAC, 3-30 second Pulse Width Modulated signal.

NOTE: Not all inputs or pin jumpers will be used. See Configuration instructions.

## INPUT SIGNAL REQUIREMENTS

- 4-20 MILLIAMP** - source controller must supply 20 milliamps at 12 volts DC into a 600 Ohm load.  
NOTE: 20 milliamps at 24 volt DC is not suitable.
- 0-10 VOLT** - signal must be supplied with at least 20 milliamp current. Wiring between controller and TCB must be kept short to minimize electrical noise.
- TTL** - logical “1” must be a DC signal greater than 4.5 volts for 3 milliseconds. Logical “0” must be less than 0.5 volts DC for 3 milliseconds.
- AC PULSE** - Must be 120 volts AC  $\pm$  20% for a period of 3 to 30 seconds.

## REPLACEMENT PARTS AND PARTS KITS

There are no user serviceable parts on the TCB, however, the accessories listed in Table 3 aid in the use and testing of the TCB/electric valve system.

## TROUBLESHOOTING

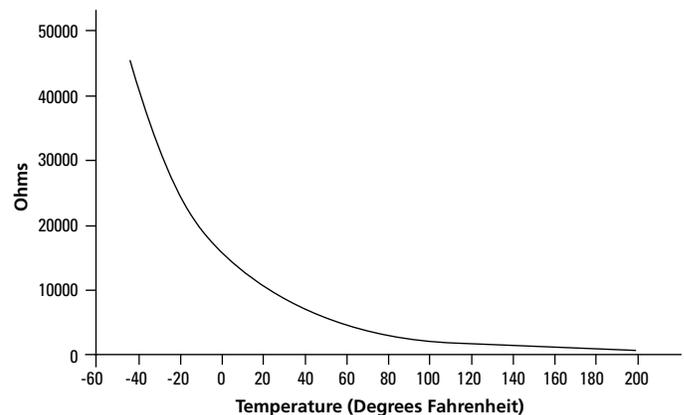
If a step motor is suspected to have failed, a simple resistance check may be made of the motor windings, however, actual winding failures are rare. Therefore Sporlan developed a diagnostic instrument, the SMA-12, to test our step motors. The SMA-12 is a step motor actuator that will operate all 12 volt DC bipolar step motor valves, as well as test the continuity of the valve wiring and motor. The step rate can be selected at 1, 50, 100 or 200 steps-per-second. At the one step-per-second rate the SMA-12 will test the continuity of the valve wiring and motor. The SMA-12 can also be used to manually open, position, or shut the valve should the controller fail. If contaminants are suspected, the SMA-12 can be used to drive the valve fully open to purge the foreign material.

## TEST POINTS and PIN JUMPERS

- TP1** - Test Point 1 - positive connection point to millivolt voltmeter to read set point temperature
- TP2** - Test Point 2 - negative connection point as above
- P1** - Pin Jumper 1 - voltage or current input selector
- P2** - Pin Jumper 2 - TTL logic or 120 VAC Pulse Width Modulated signal input selector
- P4** - Pin Jumper 4 - internal power selector - DO NOT CHANGE
- P5** - Pin Jumper 5 - force valve open switch - valve will open and will remain open as long as jumper is installed. See **Pumpdown** above.
- P6** - Pin Jumper 6 - force valve closes switch - valve will close and remain closed while jumper is installed. See **Pumpdown** above.
- P7** - Pin Jumper 7 - temperature sensor enable selector
- P8** - Pin Jumper 8 - “open on rise” logic selector
- P9** - Pin Jumper 9 - “close on rise” logic selector
- P10** - Pin Jumper 10 - SEI .5 to SEI-11, and SER valve selector (1596 step stroke)
- P11** - Pin Jumper 11 - CDS-8 or SDR-3, 3X and SEI-30 valve selector (3193 step stroke)
- P12** - Pin Jumper 12 - all other valves selector (6386 step stroke)

NOTE: Pin 8 causes valve to open on temperature rise above set point.  
Pin 9 causes valve to close on temperature rise above set point.

**Figure 3**  
**TEMPERATURE SENSOR RESISTANCE**



When a system component does fail, it is important to first determine whether the failure is the valve, the TCB, or the external controller (if used).

## TEST THE VALVE

The resistance of the motor winding may be tested without opening the system.

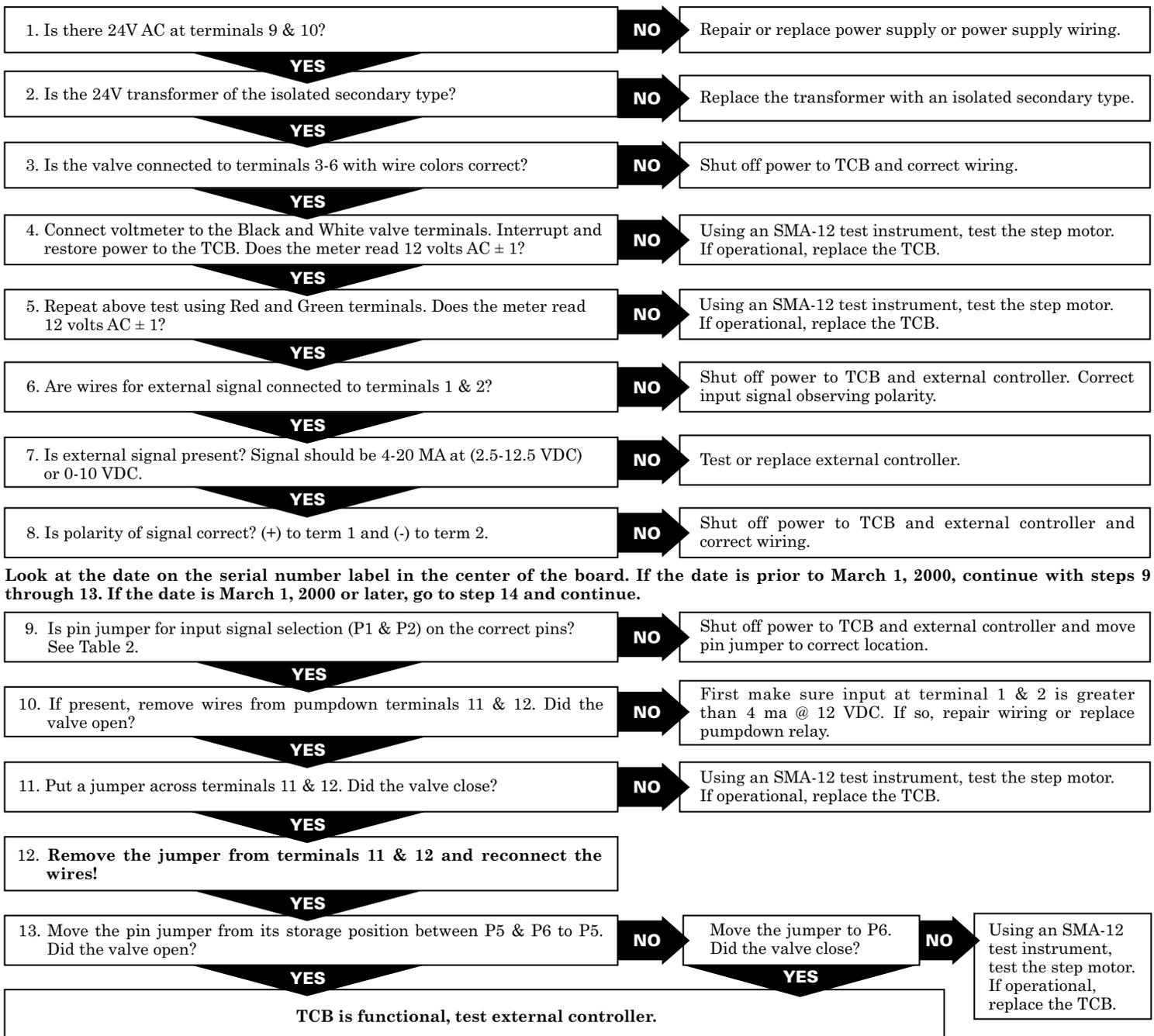
1. Remove power from the external controller and/or TCB.
2. Remove the valve leads from TCB.
3. Measure the resistance between the black and white leads of the valve. The resistance should be 75 Ohms for brass housed valves with the valve at room temperature or about 65 Ohms if the valve is at -40°F. The resistance for stainless steel housed valves should be 100 Ohms with the valve at room temperature.
4. Measure the resistance between the green and red leads. This value should be within  $\pm$  5% of the resistance between the black and white leads.
5. Measure the resistance from any lead to valve body. Resistance should be infinite, that is to say, open.

## TEST THE TCB

The flow charts that follow are designed to assist in diagnosing a possible TCB failure. All measurements should be made with a **Digital Multimeter**.

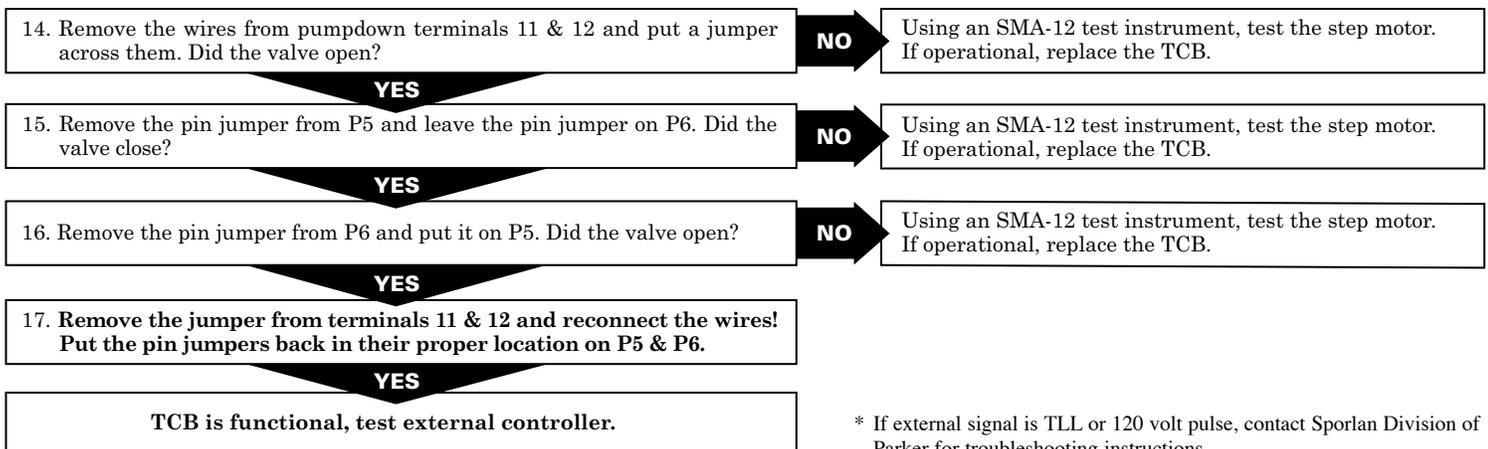
# TROUBLE SHOOTING GUIDE – TCB Operating on External Signal (4-20 ma or 0-10 VDC)\*

Note: Before testing the TCB, make certain the valve is operating. See “Test the Valve” instructions.



Boards manufactured after March 1, 2000 will have a pin jumper on both P5 and P6. The boards are shipped with the jumpers on one post of P5 & P6. With the pin jumpers in this position, the valve will close when the pumpdown relay is energized. If both P5 & P6 are enabled, the valve will open when the pumpdown relay is energized.

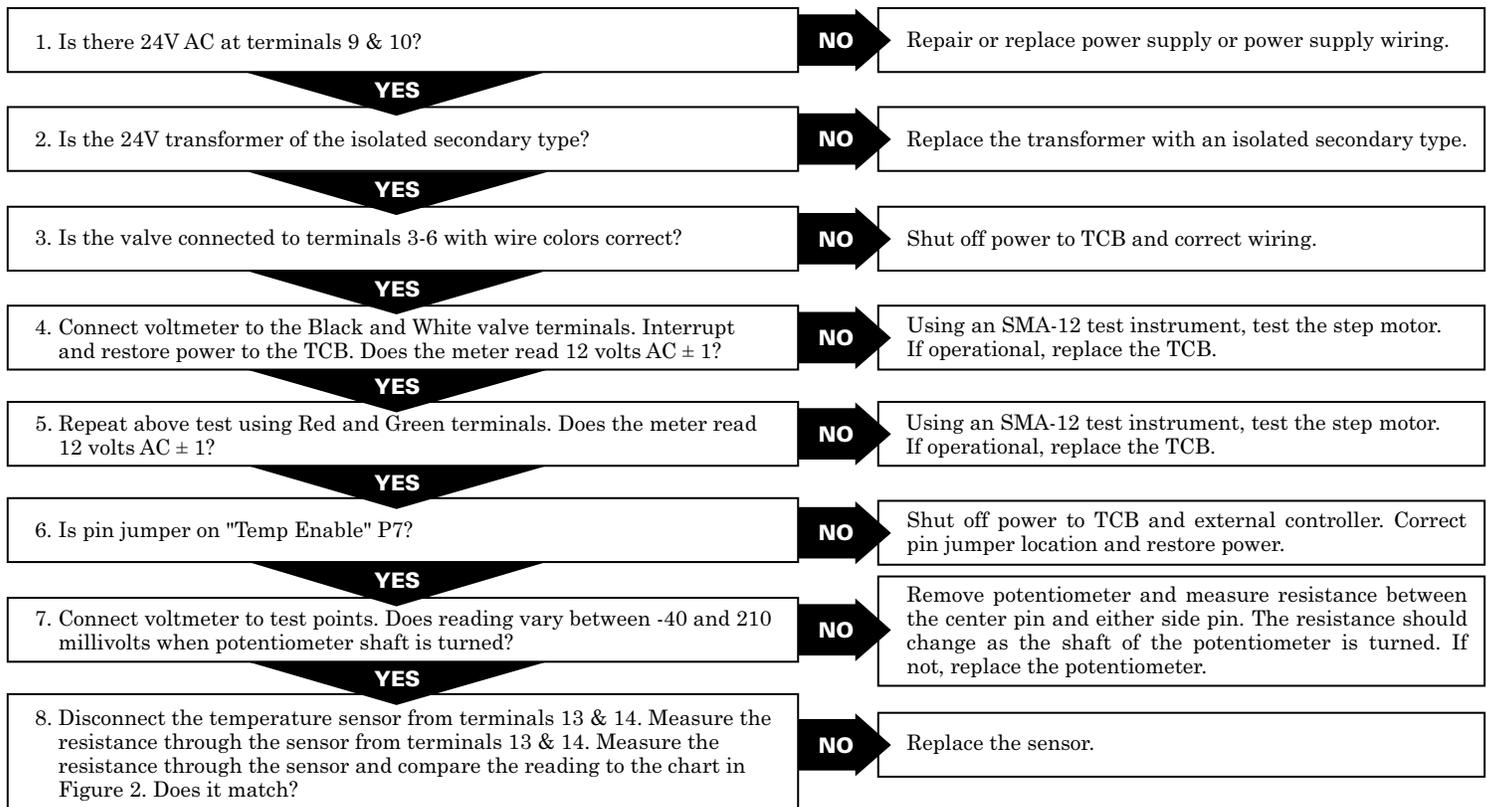
For testing purposes, make sure the pin jumpers are on both posts of pins P5 & P6.



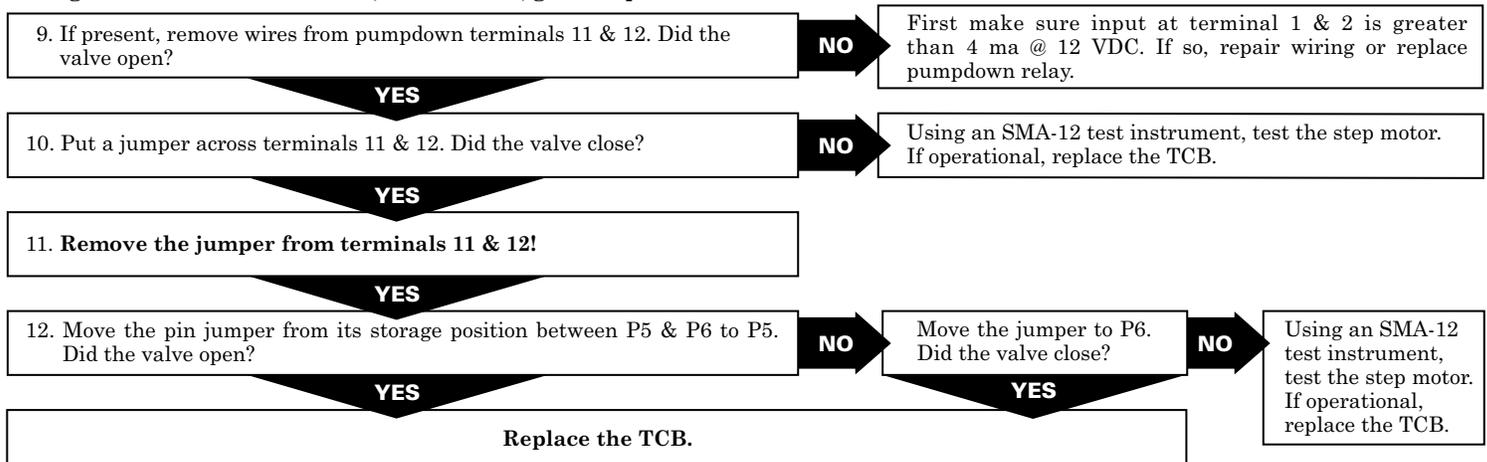
\* If external signal is TLL or 120 volt pulse, contact Sporlan Division of Parker for troubleshooting instructions.

# TROUBLE SHOOTING GUIDE – TCB Operating as Standalone Controller

Note: Before testing the TCB, make certain the valve is operating. See “Test the Valve” instructions.

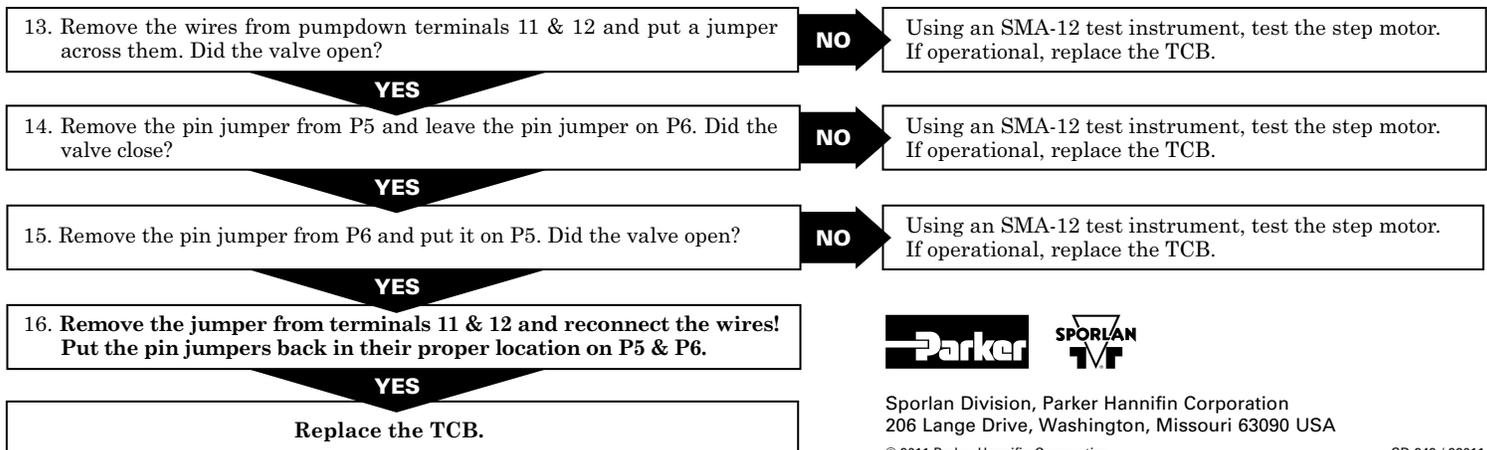


Look at the date on the serial number label in the center of the board. If the date is prior to March 1, 2000, continue with steps 9 through 12. If the date is March 1, 2000 or later, go to step 13 and continue.



Boards manufactured after March 1, 2000 will have a pin jumper on both P5 and P6. The boards are shipped with the jumpers on one post of P5 & P6. With the pin jumpers in this position, the valve will close when the pumpdown relay is energized. If both P5 & P6 are enabled, the valve will open when the pumpdown relay is energized.

For testing purposes, make sure the pin jumpers are on both posts of pins P5 & P6.



Sporlan Division, Parker Hannifin Corporation  
206 Lange Drive, Washington, Missouri 63090 USA